

Superfund Division QAPP Final Checklist - 2007

**USEPA
REGION 4 QUALITY ASSURANCE SECTION
QAPP SUPERFUND DIVISON FINAL CHECKLIST 2007**

QAPP Title: *Barite Hill / Nevada Goldfields Superfund Site*
 Project Location: *McCormick, SC*
 Originating Organization: *USGS*
 QAPP Date: *8/27/2012*
 Receipt Date: *8/24/2012*
 Review Date: *9/24/2012*
 Reviewer: *C. Teichert*
 EPA Regional Project Manager: *C. Teichert*
 EPA Project Officer: *Pamela Walraven*

Topic covered in accordance with requirements: ☒ Yes ☐ No

☐ Yes - Indicates that the topic/element was covered in sufficient detail to meet EPA's requirements as specified in this checklist.

☐ No - Indicates that the topic/element covered in the QAPP does not provide sufficient detail to meet EPA's requirements or the topic is entirely missing from the document.

Element	Meets Requirements <input type="checkbox"/> Yes <input type="checkbox"/> No
A-1. Title and Approval Page	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Title of QAPP	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Organization's Name: Both the name of the organization preparing the QAPP and the organization conducting the project or the grantee's name.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Dated Signature of Project Manager: Both the originating organization's PM and EPA's corresponding PM and/or PO.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Date and Signature of Quality Assurance Manager's approval for the originating entity and for EPA.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

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Other Signatures as Needed:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
A-2. Table of Contents: Including Tables, Figures and Appendices	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
A-3. Distribution List: Including Addresses of all entities or agencies requiring copies of the QAPP	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
A-4. Project - Task Organization	
Identifies key project personnel, specifies technical disciplines, details their roles/responsibilities and details the chain of command	<input type="checkbox"/> Yes <input type="checkbox"/> No
Organization chart provided: Depicts lines of authority, independence (of QA manager), and reporting responsibilities. Org- chart also contains entries for all agencies, contractors and individuals responsible for performing QAPP preparation, sample collection, laboratory analysis, data verification, review and validation, data quality assessment; and project oversight responsibilities.	<input type="checkbox"/> Yes <input type="checkbox"/> No
A-5. Problem Definition/Background.	
Clearly states the particular environmental problem to be solved, decision to be made, or outcome to be achieved. Include sufficient background information to provide a historical, scientific, and regulatory perspective for this particular project.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides historical and background information concerning prior environmental investigations or assessments performed at the site. Discusses the data collected from these prior investigations and identifies any additional information that may be contained in computer databases (secondary data), etc.	<input type="checkbox"/> Yes <input type="checkbox"/> No

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A-6 Project/Task Description	
Provides a summary of all work to be performed, products to be produced, and the schedule for implementation. Lists the actual measurements to be made: Including in-situ field measurements, fixed laboratory measurements, or any other type of information collected as part of the project.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Cites applicable regulatory standards or criteria such as action limits, ARARs, PRGs, MCLs, risk assessment screening levels, etc. Must provide the actual numerical criteria for the above items.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies all instruments/equipment needed to conduct project and identifies all key study personnel (field technicians, chemists, risk assessors, engineers, project managers, quality assurance managers, etc.)	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides work schedule for all tasks including report preparation, response to comments, etc.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies all required reports, records, data reports, quality assurance reports/documents	<input type="checkbox"/> Yes <input type="checkbox"/> No
A-7. Data and Field Quality Objectives and Criteria for All On-Site and Off-Site Measurement Data	
Provides the Data Quality Objectives in accordance and compliance with EPA's Data Quality Objective Process (EPA-QA/G-4) document. Lists the seven steps of the DQO process and provides the project-specific information pertaining to each of these steps.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Applies the DQO process to the project study undertaken. Provides the qualitative and quantitative data quality objectives for all aspects of the project. Must provide clearly	<input type="checkbox"/> Yes <input type="checkbox"/> No

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delineated project objectives such as determining the presence/absence of potential contaminants, nature and extent of contamination, determining whether human health is affected. Must provide a list of decisions and alternative actions (remediation, removal, further assessments, no further action, etc.).	
Provides all regulatory standards/criteria as part of DQO process (action limits, ARARs, PRGs, MCLs, etc.) on an analyte by analyte basis.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides a list of all the critical contaminants/analytes along with their respective detection limit requirements (for chemical parameters) and QA/QC requirements.	<input type="checkbox"/> Yes <input type="checkbox"/> No
A-8. Special Training Requirements and Special Certifications	
Identifies how training needs are determined and lists all training requirements for the project. Specifies whether certain professionals require a license or certification to perform duties as required by federal or state laws.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies where training records will be maintained	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies how any new training requirements are communicated to program/upper management	<input type="checkbox"/> Yes <input type="checkbox"/> No
Discusses the importance of QA training and discusses how this training is provided.	<input type="checkbox"/> Yes <input type="checkbox"/> No

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A-9. Documentation and Records	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides a comprehensive list of the documents and records required for this project (including raw data, field logs, audit reports, QA reports, progress or status reports, analytical data reports, data validation reports/data quality assessments reports.)	<input type="checkbox"/> Yes <input type="checkbox"/> No
Specifies the turnaround time for laboratory data deliverables (both hardcopy and electronic formats). Provides hardcopy data package content requirements and electronic data requirements	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides the retention time and location of study records, reports and formal documents.	<input type="checkbox"/> Yes <input type="checkbox"/> No
B-1. Sampling Process Design	
Provides a table with type and number of samples required for collection such as surface, subsurface, or groundwater.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides design of the sampling/collection network	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides maps or diagrams with sample locations/collection locations and provides table with frequency of sampling events	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides the sample matrices slated for collection in the sample table (surface soil, subsurface soil, sediment, surface water, groundwater samples, etc).	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides an extensive discussion regarding the rationale for the sampling design. (This also includes a discussion regarding the rationale and relevance of the analytical program).	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides a table identifying the chemical	<input type="checkbox"/> Yes <input type="checkbox"/> No

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parameters/analytes of interest for each collected sample along with the required detection limits, regulatory standards/criteria, QA/QC criteria, analytical method number, sample container requirements, sample preservation requirements, sample volume requirements and holding time criteria.	
B-2. Sampling Method Requirements	
Provides the required field sample collection procedures, protocols and methods	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides a list of sampling/collection equipment (including make and model of equipment).	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies on-site support facilities that are available to field staff.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies key study personnel in charge of or overseeing sampling/collection activities	<input type="checkbox"/> Yes <input type="checkbox"/> No
Describes equipment decontamination procedures and requirements. Discusses whether sampling equipment is dedicated or non-dedicated.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides table listing sample container requirements and preparation requirements for these containers (if provided by laboratory, clearly states such).	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides table listing sample preservation requirements (for chemical parameters) and holding time criteria (where applicable).	<input type="checkbox"/> Yes <input type="checkbox"/> No
B-3. Sample Handling and Custody Requirements	
Provides a detail description of the procedures for post sample handling (once the sample has been collected).	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides a detailed description of the chain-of-custody procedures.	<input type="checkbox"/> Yes <input type="checkbox"/> No

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B-4. Analytical Method Requirements	
Clearly identifies the extraction, digestion, analytical methodologies (provides the actual method numbers) to be followed (includes all relevant options or modifications required), identifies the required instrumentation. Provides laboratory SOPs or QAM.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides validation criteria for non-standard or unpublished methodologies proposed for use for a given study.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies individual(s) responsible for overseeing the success of the analysis and for implementing corrective actions if deemed necessary.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Specifies the turnaround time for hardcopy and electronic laboratory data deliverables.	<input type="checkbox"/> Yes <input type="checkbox"/> No
B-5. Quality Control Requirements	
Identifies the type, number and frequency of procedures and frequency of QA/QC sample collection along with the required QC statistically derived limits for each analyte (for spike samples, internal standards, surrogate spikes).	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides the statistical equations for accuracy, precision, and comparability. Specifies the acceptance criteria for these measurements.	<input type="checkbox"/> Yes <input type="checkbox"/> No
B-6. Instrument or Equipment Testing and Inspection Requirements	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides a list of all in-situ testing instruments and field equipment.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides the technical criteria by which the field instruments or sampling equipment is	<input type="checkbox"/> Yes <input type="checkbox"/> No

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checked for acceptable performance.	
Provides a comprehensive list of the supplies required for the project	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies the individual(s) responsible for checking and inspecting consumables and supplies	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides the acceptance criteria consumable item, instrument and equipment	<input type="checkbox"/> Yes <input type="checkbox"/> No
Describes equipment and corrective maintenance practices to ensure that on-site equipment or instruments are performing within the required specifications	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies the availability and location of spare parts	<input type="checkbox"/> Yes <input type="checkbox"/> No
B-7. Instrument Calibration and Frequency	
Identifies all equipment requiring calibration and discusses the frequency of calibration	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies the calibration requirements for each instrument requiring calibration. (For fixed laboratory this may be in the SOPs or QA manual).	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides the calibration requirements and calibration acceptance criteria for each type of equipment or instrument. (Again for the off-site laboratory this information will reside in the method-specific SOPs and the QA manual).	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies the type of documentation required for calibrations and instrument checks and discusses how calibrations are traced back to specific instruments for each analytical parameter. (Once again for the off-site laboratory this information will reside in the method-specific SOPs and the QA manual).	<input type="checkbox"/> Yes <input type="checkbox"/> No

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B-8 Inspection/Acceptance Criteria and Requirements for Supplies and Consumables	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides a comprehensive list of the consumables such as, solvents, reagents, buffer solutions and other consumables or supplies required for the project.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides the acceptance criteria for each of these items.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies those individual(s) responsible for checking/inspecting supplies and consumables.	<input type="checkbox"/> Yes <input type="checkbox"/> No
B-9. Data Acquisition Requirements for Non-Direct Measurements	
Identifies the type and frequency of non-direct measurement techniques for the project (for computer databases, literature searches, etc.)	<input type="checkbox"/> Yes <input type="checkbox"/> No
Clearly identified and describes the limitations of such data	<input type="checkbox"/> Yes <input type="checkbox"/> No
Discusses the rationale for using this data and explains its relevance to the project	<input type="checkbox"/> Yes <input type="checkbox"/> No
Specifies how limitations in this data will be communicated to all end data users and stakeholders.	<input type="checkbox"/> Yes <input type="checkbox"/> No
B-10. Data Management	
Describes the record-keeping, archival and retrieval requirements for hard-copy and electronic information produced during the course of the project.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides audit checklists or other standardized forms in an appendix to the QAPP.	<input type="checkbox"/> Yes <input type="checkbox"/> No

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Describes data handling equipment and procedures used to process, compile and analyze data (provides a complete list of computer hardware and software needs) - Specifies whether computer databases will have restricted access or will be password protected Discusses how the accuracy of computer databases is assured.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Describes process for assuring that applicable Office of Information Resource Management requirements are satisfied (mainly this is required if the data will be entered into an EPA or other Federal Database)	<input type="checkbox"/> Yes <input type="checkbox"/> No
C-1. Assessments, Audits and Corrective Actions	
Lists the required number, frequency and type of assessments with approximate dates and names of individual(s) responsible for performing these assessments	<input type="checkbox"/> Yes <input type="checkbox"/> No
Discusses one or more of the following types of assessments: peer reviews, technical audits, surveillance, management system reviews, readiness reviews, quality system audits, performance evaluations, data quality assessments.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies the individual(s) performing these assessments and discusses the authority and independence of these individual(s) in relation to those being assessed	<input type="checkbox"/> Yes <input type="checkbox"/> No
Provides a description of the types of corrective actions that may be instituted to resolve any issues raised during the audit	<input type="checkbox"/> Yes <input type="checkbox"/> No
Discusses where audit findings will be documented and how the audit findings will be communicated to all key project staff, state and EPA personnel responsible for the study	<input type="checkbox"/> Yes <input type="checkbox"/> No

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oversight	
C-2. Reports to Management: Identifies the frequency and distribution of the following types of reports:	
Project Status Reports	<input type="checkbox"/> Yes <input type="checkbox"/> No
Results of Assessments or Audits	<input type="checkbox"/> Yes <input type="checkbox"/> No
Results of periodic Data Quality Assessments	<input type="checkbox"/> Yes <input type="checkbox"/> No
QA Audit Reports	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies the individual(s) responsible for preparing, reviewing and receiving these reports - discusses the retention time for maintaining such reports	<input type="checkbox"/> Yes <input type="checkbox"/> No
D-1 & D-2. Data Review, Verification and Validation	
Identifies the guidance documents or SOPs governing the data review, verification and validation processes	<input type="checkbox"/> Yes <input type="checkbox"/> No
Clearly discusses the criteria by which data will be accepted or rejected and provides a comprehensive list of the data flags or qualifiers that will be assigned to non-compliant data points (including the definitions for each of these flags)	<input type="checkbox"/> Yes <input type="checkbox"/> No
Describes the process, and provides the criteria by which the data will be assessed for its overall usability and intended purpose.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies the individual(s) responsible for validating the data and identifies the company or consultant for whom they work (Note: EPA recommends using an independent second or third party validator or at least a person that is unaffiliated with the laboratory performing the analyses on site samples).	<input type="checkbox"/> Yes <input type="checkbox"/> No

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Identifies how problems associated with the laboratory will be documented and communicated to all end data users and stakeholders (where will the results of the data validation process be documented)	<input type="checkbox"/> Yes <input type="checkbox"/> No
D-3. Reconciliation of the Data to the Project-Specific DQOs	
Describes the process by which the on-site and off-site analytical data will be reconciled to the project-specific DQOs (especially if the data is non-compliant)	<input type="checkbox"/> Yes <input type="checkbox"/> No
Discusses how limitations in the final data set will be documented and communicated to all end data users and stakeholders.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Describes the circumstances under which data would be rejected and removed from the final data set	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies the individual(s) responsible for reconciling the data to the project-specific DQOs	<input type="checkbox"/> Yes <input type="checkbox"/> No
Identifies the SOP or guidance document outlining the DQO reconciliation process	<input type="checkbox"/> Yes <input type="checkbox"/> No

Note: EPA's guidance and requirements documents for the DQO process, QAPP preparation, Data Validation and Data Quality Assessments, are located at www.epa.gov/quality. These documents include:

Final QAPP Disposition:

____ *Approved, no comments*

Signature of Designated Approval Official (DAO) _____

Signature of Section Chief of the DAO _____

____ *Not Approved, Address Comments, Submit Revised QAPP to the EPA Designated Approval Official*

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References

1. EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, EPA/240/B-01/002 (March 2001).
2. EPA Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4, EPA/240/B-06/001 (February 2006).

Both documents can be accessed at the following website: www.epa.gov/quality - Select guidance from the menu options to the left of the screen.



United States Department of the Interior

U.S. GEOLOGICAL SURVEY
3916 Sunset Ridge Road
Raleigh, NC 27607

Ms. Candice Teichert
Remedial Project Manager
Superfund Site Evaluation Section
Superfund Division
U.S. Environmental Protection Agency
61 Forsyth Street
Atlanta, GA. 30303

August 27, 2012

Dear Candice,

As per your recent discussions with Melinda Chapman, please find enclosed the Quality Assurance Project Plan (QAPP) for the upcoming borehole geophysical logging work and surface geophysical surveys to be conducted by U.S. Geological Survey North Carolina and South Carolina Water Science Centers in selected wells and areas near the Barite Hill/Nevada Goldfields Superfund Site near McCormick, South Carolina. The work should take place during September 2012 through September 2013. We will be in contact with you to schedule specific dates in the field. If you have any questions, please do not hesitate to call me at (919) 571-4000.

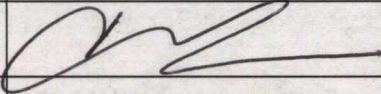
Sincerely,

Holly S. Weyers, Director
USGS, North Carolina Water Science Center

Enclosure

Cc: Melinda Chapman, Project Chief
Rose Pinnix, Administrative Officer

SECTION A: Project Planning Elements

A1. Title (Project Name)	Barite Hill/Nevada Goldfields Superfund Site	
Project Location:	McCormick, McCormick County, South Carolina	
Project Requestor and Organization:	Candice Teichert EPA Region 4/Superfund Division/Superfund Site Evaluation Section 61 Forsyth Street Atlanta, GA 30303	
Project Leaders Name, Position, and Organization:	Melinda Chapman, Groundwater Specialist USGS NC WSC	
Project Leaders Signature:		Date:
Technical Reviewer's Name and Position:	Benjamin Bentkowski, Hydrogeologist U. S. EPA Region 4 / Superfund Division / Technical Services Section	<i>Candice Teichert</i> <i>RPM</i>
Technical Reviewer's Signature		Date: <i>9/24/2012</i>
A3. Distribution List		
Benjamin Bentkowski	US EPA Region 4, Superfund Division, Atlanta, GA	
A4. Project Personnel (list below):	Organization	Responsibilities
Melinda J. Chapman	USGS NC WSC, Raleigh, NC	Project Chief
Brad A. Huffman	USGS NC WSC, Asheville, NC	Field Supervisor
Bernice A. Allen	USGS NC WSC, Raleigh, NC	Health and Safety Advisor
Kristen B. McSwain	USGS NC WSC, Raleigh, NC	Project/Field Hydrologist
William S. Caldwell	USGS NC WSC, Raleigh, NC	Field Hydrologist
Whitney Stringfield	USGS SC WSC, Columbia, SC	Health and Safety Advisor
Timothy H. Lanier	USGS SC WSC, Columbia, SC	Field Hydrologist
William F. Falls	USGS SC WSC, Columbia, SC	Field Hydrologist

Matthew D. Petkewich	USGS SC WSC, Columbia, SC	Field Hydrologist
James E. Landmeyer	USGS SC WSC, Columbia, SC	Field Hydrologist
A5. Problem Definition (Objectives) and Background:	The Barite Hill area borehole geophysical logging and surface geophysical surveys addresses the delineation and orientation determination of bedrock fractures, areal and vertical contaminant distribution within the regolith and bedrock in selected areas, and discharge of contaminated groundwater to surface water in the surrounding creek, as related to potential conductive contaminant migration in the groundwater system.	
A6. Project Description:	This project will include the collection of borehole geophysical logs from five open-borehole and an estimated five screened wells. Logs to be collected include caliper, electrical resistivity, fluid temperature and resistivity, and natural gamma logs, optical televiewer images, and potentially heat-pulse or electromagnetic flowmeter (both ambient and stressed). Water-quality profiles also will be run in the screened wells using a multi-probe. Surface geophysical surveys will include the use of an electromagnetic conductivity meter to delineate areas of conductive contaminant plumes in five selected locations and delineation of groundwater discharge areas in the surrounding creek using fiber-optic distributed temperature sensing methods.	
Decision(s) to be made based on data/interpretations:	US EPA will use these interpretations of fracture depth and orientation, and borehole and surface contaminant distribution, to assess potential source areas of conductive groundwater contamination, the potential for the migration of contaminated groundwater offsite, potential areal expansion of sampling, and design of remediation activities at the Barite Hill Superfund site.	
Field Study Dates:	September 2012 through February 2013	
Projected completion date for USGS Scientific Investigations or Open-File Series Report describing results/interpretations:	September 30, 2013	
A7. Quality Objectives and Criteria: All borehole geophysical logs and surface geophysical surveys are collected under the guidance of experienced USGS borehole and surface geophysical personnel and groundwater hydrologists. USGS Office of Groundwater Branch of Geophysics provides ongoing internal training and guidance on		

borehole geophysical logging and surface geophysical surveys.

A8. Special Training/Certifications: All personnel collecting borehole geophysical logs and running surface geophysical surveys in the field have completed either the 40-hour Hazwoper safety training or 8-hour HazWoper refresher safety training, and have completed baseline medical surveillance.

A9. Documents and Records: IAG DW #14946085

Section B: Data Generation and Acquisition

B1. Sampling Design:

Wells to be logged and surface geophysical survey areas will be selected in coordination with EPA and their consultants based on spatial distribution and presence of conductive groundwater contamination and known areas of low pH/high specific conductance surface water occurrence.

B2. Sampling Methods:

Completion of the borehole geophysical logging of the three newly drilled open-borehole bedrock wells will be under the guidance of EPA and their consultants in order to minimize driller standby time. Logging of the two existing open-borehole bedrock wells and selected screened wells will be conducted during drilling activities logging downtime for the new wells. Digital geophysical logs and images will be made available to the US EPA and their consultants as soon as the data have been quality assured. USGS NC WSC field personnel will follow data collection procedures as described in internal training documents from the USGS Office of Groundwater Branch of Geophysics (<http://water.usgs.gov/ogw/bgas/g2t.html>) and USGS NC WSC Groundwater Quality Assurance Plan. Additional discussion of borehole logging methods is presented in the following publications: USGS fact sheet "Advances in Borehole Geophysics for Ground-Water Investigations, (<http://water.usgs.gov/ogw/bgas/publications/FS-002-98/>); USGS Techniques of Water-Resources Investigation Report Book on "Borehole Geophysical Methods Applied to Groundwater Investigations" (<http://pubs.usgs.gov/twri/twri2-e2/>); and the US EPA Region 4 [Field Branches Quality System and Technical Procedures](http://www.epa.gov/Region4/sesd/fbqstp/)¹, (<http://www.epa.gov/Region4/sesd/fbqstp/>), where applicable. All field notes regarding logging system setup, tool testing, weather conditions, water level, well identification, and other logging notes will be recorded in a log book.

Water-quality probe profiling in selected screened wells will be conducted using internal USGS quality assurance plan guidance (<http://nc.water.usgs.gov/usgs/info/qaplan/quality.html>). Surface geophysical surveys will be conducted under guidance of the USGS Office of Groundwater Branch of Geophysics (<http://water.usgs.gov/ogw/bgas/>). All data will be made available to the EPA and their consultants as soon as it has been quality assured. An overview of the fiber-optic distributed temperature sensing method is described here <http://water.usgs.gov/ogw/bgas/fiber-optics/>.

B3. Sample Handling and Custody:

All borehole geophysical tools and the downhole logging cable will be rinsed using a diluted

¹ <http://www.epa.gov/region4/sesd/fbqstp/index.html>

Alconox solution and deionized water prior to, and after logging each well, to prevent cross contamination. Decontamination procedures will be tested by collecting dissolved ion and metals samples of the rinse water and submitting to USGS National Water Quality laboratory, Denver, Colorado, for analysis.

B4. Analytical Methods:

USGS NC WSC personnel will use WellCad software to display and interpret geophysical logs and images for fracture delineation, including depth and orientation. Rockworks software will be used to create structural diagrams and three-dimensional fracture rendering. Equipment specific interpretation software will be used to process the surface geophysical data. Data will be exported to report figures and potentially imported into ArcGIS software if possible. The major ion/metals borehole tool rinse list of constituents will be forwarded to the EPA for their review prior to sample collection.

B6. Instrument/Equipment Testing, Inspection, and Maintenance:

All borehole geophysical tools, water-quality profile probes, and surface geophysical equipment are calibrated in the manufacturer's factory during initial configuration or servicing. Additionally, the caliper tool is calibrated in the field using two representative diameters for the well casing and open borehole diameter. The heat-pulse and electromagnetic flowmeter tools will be tested in a standpipe the office prior and subsequent to field deployment. The optical televiewer magnetometer will be compared to a magnetic compass in the field each week. Borehole tools and the logging cable are regularly inspected for signs of wear. Water-quality probe calibration is conducted on the first day of field work and checked during following days. Field calibration of the fiber-optical distributed temperature sensing cable is conducted daily during data collection activities.

B7. Instrument/Equipment Calibration and Frequency:

The caliper tool is calibrated at each well to be logged to insure proper reading of borehole diameter. The heat-pulse flowmeter tool will be tested prior to and subsequent to field logging using a standpipe and pump in the office. The OTV tool magnetometer will be tested each week in the field against a hand-held magnetic compass. The water-quality profiling probe will be calibrate the morning prior to first use, and checked each morning of field work thereafter. The fiber-optic distributed temperature sensing cable will be checked continually during field data collection.

B8. Inspection/Acceptance of Supplies and Consumables

N/A

B9. Non-direct Measurements:

Field electromagnetic conductivity surveys will be conducted by walking over selected areas of investigation along profile lines. Locations of line end points will be surveyed using a differential global positioning system. Measurement points along the profile lines will be surveyed for distance and land-surface altitude change.

B10. Data Management:

All borehole geophysical data will be processed using WellCad software for interpretation of

fracture depths and orientations. These data will be provided to the US EPA and their consultants in both electronic spreadsheet and area diagram (rose/stereonet) format. Well water-quality profiles will be forwarded using electronic spreadsheets. Surface geophysical surveys will be processed using manufacturer software and exported for report figures and potentially linked to an ArcGIS map. Both borehole and surface geophysical data and interpretations will be archived electronically in accordance with USGS Office of Groundwater policy.

Section C: Assessment and Oversight Elements

C1. Assessments and Response Actions:

An assessment of the dominant fracture depths and orientations and vertical contaminant distribution profiles will be provided for each well logged to the US EPA Technical Reviewer. Identification of water bearing fractures will be noted and correlated with other fracture characteristics in the area as data are available. These borehole fracture orientations will be compared to surface geologic mapping data in the vicinity of the wells if available from previous surface geologic mapping. Surface geophysical surveys will be compared to resistivity surveys conducted earlier in some overlapping areas.

C2. Reports to Management:

A USGS Scientific Investigations or Open-File Series report will be prepared to provide borehole geophysical log fracture interpretation, vertical conductive contamination profiling, and surface geophysical areal conductive plume and groundwater discharge area summary results to the US EPA Technical Reviewer. All data and interpretations will be provided in electronic format. This report will be released to the public online after EPA and USGS approval.

Section D: Data Validation and Usability Elements

D1 Data Review, Verification, and Validation:

USGS NC WSC field personnel will follow data collection procedures as described in internal training documents from the USGS Office of Groundwater Branch of Geophysics and USGS NC WSC Groundwater Quality Assurance Plan and the US EPA Region 4 [Field Branches Quality System and Technical Procedures](http://www.epa.gov/Region4/sesd/fbqstp/) (<http://www.epa.gov/Region4/sesd/fbqstp/>), where applicable. All data will be reviewed by USGS colleagues and EPA personnel as part of the USGS report review process.

D2 Verification and Validation Methods:

If available, downhole geophysical fracture orientations will be correlated with surface geologic mapping data. Vertical conductive plume profiling in selected wells will be compared to available groundwater-quality data from the same wells. Overlap of surface geophysical methods in areas of known conductive plume contamination will be conducted where possible. These methods have been approved by the USGS as part of the proposal requirements.

D3. Reconciliation and User Requirements

N/A